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DOCKET NO.: UPN-4110

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:
Dawn A. Bonnell, et al

Confirmation No.: 1230

Application No.: 10/052,024

Group Art Unit: 2858

Filing Date: January 18, 2002

Examiner: Walter Benson

For: SPATIALLY RESOLVED ELECTROMAGNETIC PROPERTY MEASUREMENT

EXPRESS MAIL LABEL NO: EL970387657US
DATE OF DEPOSIT: November 1, 2004

EL970387657US

MS Appeal Brief - Patent
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF TRANSMITTAL PURSUANT TO 37 CFR § 1.192

Transmitted herewith in triplicate is the APPEAL BRIEF in this application with respect to the Notice of Appeal received by The United States Patent and Trademark Office on **August 30, 2004**.

☒ Applicant(s) has previously claimed small entity status under 37 CFR § 1.27 .

☐ Applicant(s) by its/their undersigned attorney, claims small entity status under 37 CFR § 1.27 as:

- ☐ an Independent Inventor
- ☐ a Small Business Concern
- ☐ a Nonprofit Organization.

☐ Petition is hereby made under 37 CFR § 1.136(a) (fees: 37 CFR § 1.17(a)(1)-(4) to extend the time for response to the Office Action of to and through comprising an extension of the shortened statutory period of month(s).

	SMALL ENTITY		NOT SMALL ENTITY	
	RATE	FEE	RATE	FEE
☒ APPEAL BRIEF FEE	$170	$170	$340	$
☐ ONE MONTH EXTENSION OF TIME	$55	$	$110	$
☐ TWO MONTH EXTENSION OF TIME	$215	$	$430	$
☐ THREE MONTH EXTENSION OF TIME	$490	$	$980	$
☐ FOUR MONTH EXTENSION OF TIME	$765	$	$1530	$
☐ FIVE MONTH EXTENSION OF TIME	$1040	$	$2080	$
☐ LESS ANY EXTENSION FEE ALREADY PAID	minus	($)	minus	($)
TOTAL FEE DUE		$170		$0

☒ The Commissioner is hereby requested to grant an extension of time for the appropriate length of time, should one be necessary, in connection with this filing or any future filing submitted to the U.S. Patent and Trademark Office in the above-identified application during the pendency of this application. The Commissioner is further authorized to charge any fees related to any such extension of time to Deposit Account 23-3050. This sheet is provided in duplicate.

☒ A check in the amount of **$170.00** is attached. Please charge any deficiency or credit any overpayment to Deposit Account No. 23-3050.

☐ Please charge Deposit Account No. 23-3050 in the amount of **$ .00**. This sheet is attached in duplicate.

☒ The Commissioner is hereby requested to grant an extension of time for the appropriate length of time, should one be necessary, in connection with this filing or any future filing submitted to the U.S. Patent and Trademark Office in the above-identified application during the pendency of this application. The Commissioner is further authorized to charge any fees related to any such extension of time to deposit account 23-3050. This sheet is provided in duplicate.

Date: November 1, 2004

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DOCKET NO.: UPN-4110/N2478 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **Dawn A. Bonnell, Sergei V. Kalinin, Rodolfo A. Alvarez**

Confirmation No.: **1230**

Serial No.: **10/052,024**

Group Art Unit: **2858**

Filing Date: **January 18, 2002**

Examiner: **Walter Benson**

For: **Spatially Resolved Electromagnetic Property Measurement**

EXPRESS MAIL LABEL NO: EL970387657US
DATE OF DEPOSIT: November 1, 2004

Mail Stop Appeal-Brief Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANT'S BRIEF PURSUANT TO 37 C.F.R. § 1.192

This brief is being filed in support of Appellant's appeal from the rejections of claims 8, 9, 13, and 15 and the objections to claims 10-12, 14, and 16-19 dated April 30, 2004. A Notice of Appeal was filed on August 30, 2004.

This appeal brief is being submitted in triplicate, pursuant to 37 C.F.R § 1.192(a). Appellant respectfully requests that the examiner's final rejection be reversed and that the application be remanded to the examining group for allowance.

1. REAL PARTY IN INTEREST

The current real parties in interest in the present appeal are Dawn Bonnell, Sergei V. Kalinin, and Rodolfo A. Alvarez. The application, however, may soon be assigned to the University of Pennsylvania.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to the Appellant, the Appellant's legal representative, or the potential future Assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the present appeal.

3. STATUS OF CLAIMS

A. Claims 1-20 are pending. Claims 1-20 are reproduced in Appendix A attached hereto.

B. Claims 1-7 and 20 stand withdrawn from consideration.

C. Claims 10-12, 14, and 16-19 stand objected to but allowable if rewritten as independent claims.

D. Claims 8, 9, 13, and 15 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 6,201,401 to Hellemans et al., hereinafter "Hellemans," in view of U.S. Patent No. 6,530,266 to Adderton et al., hereinafter "Adderton."

E. Claims 8-19 are the subject of the appeal.

4. STATUS OF AMENDMENTS

No amendments have been filed subsequent to the rejection.

5. SUMMARY OF INVENTION

The invention is directed to analyzing the electromagnetic properties of a sample. Embodiments of the invention provide for the determination of impedance information of the sample's interface, the determination of a magnetic profile of the sample (withdrawn claims), and provide a system for determination of impedance information of the sample (withdrawn claims). The cited references, in contrast to the claims, only disclose determining voltage information and topograhic information of a sample.

6. ISSUES

Whether claims 8-19 patentably define over Hellemans in view of Adderton.

7. GROUPING OF CLAIMS

Group 1: Claims 8-19 stand or fall together. Each of these claims includes the feature of a ***determining impedance information of an interface based upon a measured first response and a measured second response,*** *wherein the interface is* ***an interface in a sample.*** Further, each of these claims includes the feature that the first and second response are *measured in a* ***first and second position***, respectively. Still further, each of these claims includes the feature that the ***the interface is between the first position and the second position***.

8. REMARKS

Independent claim 8 includes features that are neither disclosed nor suggested by the cited references, either taken alone or in combination, namely:

8. (Original) A method for *determining impedance information of* ***an interface in a sample***, the method comprising the steps of:
(a) applying an ac voltage to the ***sample, laterally across the interface***, the ac voltage having a predetermined frequency;
(b) disposing a cantilevered tip in a first position proximate to a surface of the ***sample***;
(c) measuring a first response of the cantilevered tip with the cantilevered tip in the ***first position***;
(d) placing the cantilevered tip in a second position proximate to the surface of the sample, ***the interface being between the first position and the second position***;
(e) measuring a second response of the cantilevered tip with the cantilevered tip in the ***second position***; and
(f) *determining* ***impedance information of the interface based upon the measured first response and the measured second response***. (emphasis added)

Hellemans does not disclose or suggest determining impedance information of the interface (conceded by the examiner in the Office Action at page 3, third paragraph). As such, the examiner relies on Adderton for disclosing determining impedance information.

Adderton, however, is directed to determing the topography of a sample (Abstract at lines 4-5). To determine topography, Adderton uses a cantilever 20 having a piezoelectric element 36 with an impedance that varies with bend. Because the impedance varies in a known relationship with bend, Adderton can determine the topography of the sample. That is, Adderton measures the impedance of one part of *the equipment itself* to determine the

sample's topography. In more detail, Adderton at c. 8, ll. 59-67 (similar to c. 11, ll. 54-60) discloses "a circuit for measuring the impedance of the piezoelectric element of self-actuated cantilever 20." Cantilever 20 is part of the measuring device 10, not the sample 28 (Adderton at Fig. 1). Adderton, therefore, does not disclose or suggest determining impedance information of the *interface in the sample* (Adderton c. 8, ll. 65-66, c. 11, ll. 60-62), as recited by the claims.

Therefore, neither reference discloses determining the impedance of the interface in the sample. Assuming arguendo that there is some suggestion or motivation to combine Adderton with Hellemans, the resulting combination would not result in the claims as recited. To explain graphically, Figure 4 of Hellemans (shown below with reference number 4 added for clarity) discloses measuring the voltage of a sample 8 using cantilever 4.

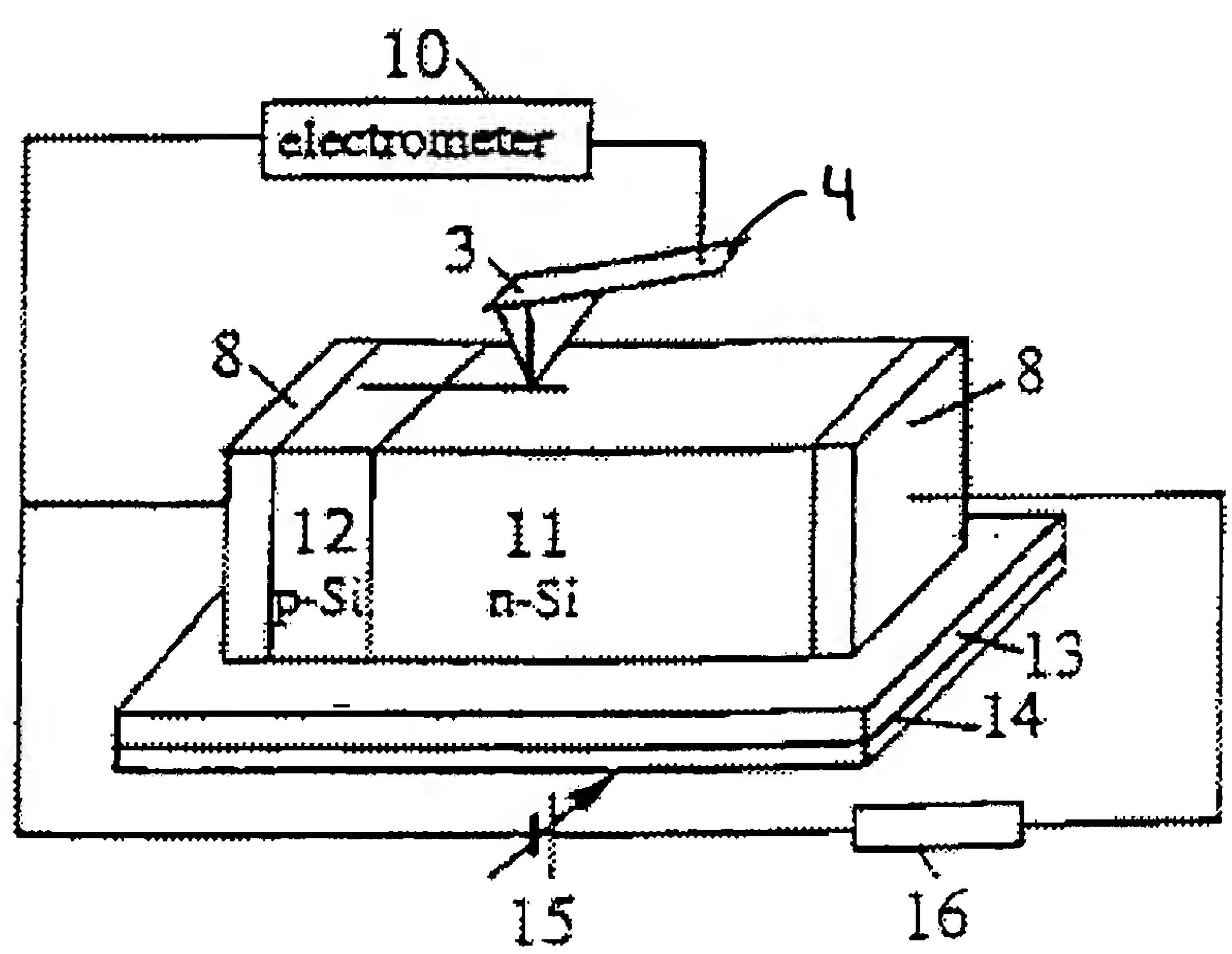


Fig. 4

Fig. 1 of Adderton (shown below) discloses determining the topography of a sample 28 by measuring the impedance of cantilever 20.

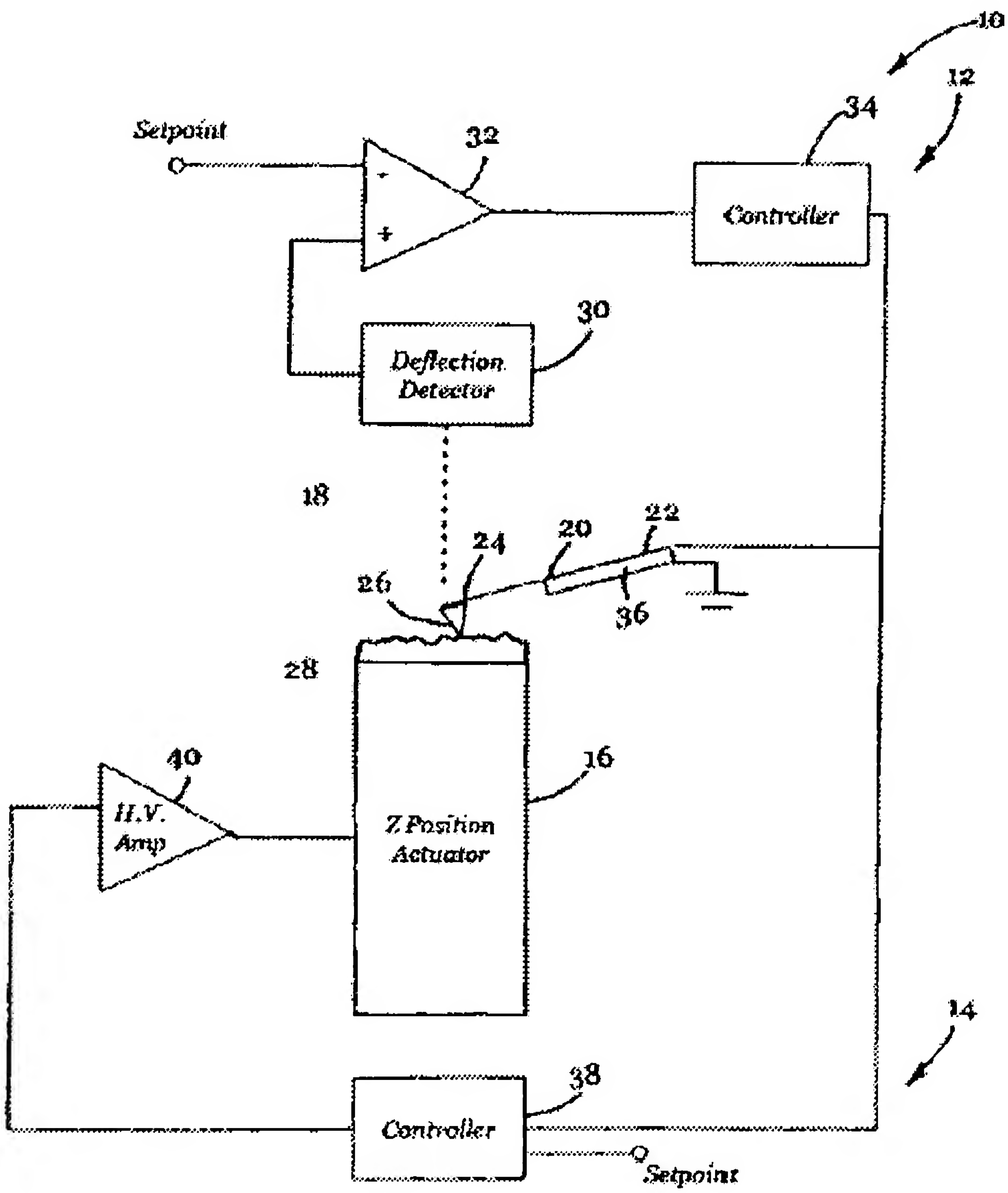
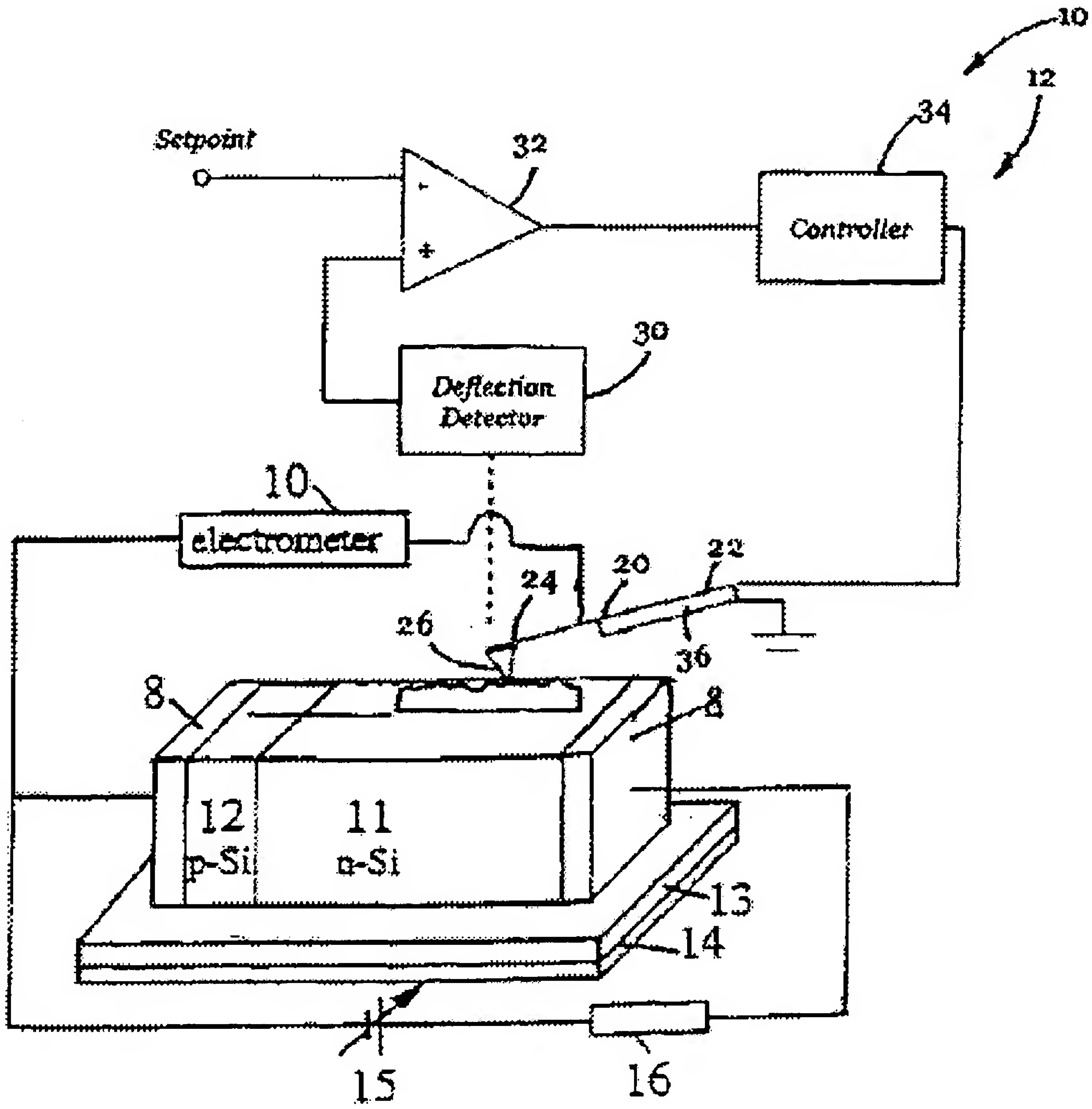


Figure 1

The combination of Hellemans and Adderton results in the use of Adderton's cantilever 20 in place of Hellemans cantilever 4 to simultaneously measure sample voltagle and topography (shown below), and does not result in determining impedance information of the interface in the sample, as recited by the claims.



In the previous Office Action, the examiner took the position that the applicant has not argued the claim language. (There is no "determine impedance of the sample interface" claimed in independent claim 8. – Office Action at page 6, lines 3-4). Claim 8, however, clearly recites "*determining **impedance information of the interface***" and "*determining impedance information of an **interface in a sample**.*" Therefore, the language of claim 8 clearly includes determining impedance information of an interface in a sample. While the applicant argued this in the previous reply, the examiner responded only by stating that the applicant's "arguments did not overcome the rejection," (Advisory Action at page 2) with no further explanation. Applicant respectfully submits that the claims clearly recite determining impedance information of the interface in a sample.

Further, even if the claims did not recite "an interface in a sample," Adderton would not render the claims obvious because Adderton does not determine impedance information

of an interface; rather, Adderton measures the impedance of a piezoelectric element – not an interface.

Further, the claims recite determining impedance information of the interface *based upon the **measured first response and the measured second response***. Even more specifically, the claims recite that the measured first and second responses are ***measured in a first and second position***, respectively. The examiner cites to Adderton at c. 8, ll. 20-35 and 59-67 and c. 11, ll. 54-60 (without explanation) for the proposition that Adderton discloses such a feature. These sections of Adderton, however, make no such disclosure. In contrast, Adderton simply discloses a conventional circuit for measuring impedance information of the piezoelectric element 36 of cantilever 20. Such a conventional circuit does not determine impedance information based on a measured first response and a measured second response. Further, such a conventional circuit for measuring impedance of a piezoelectric element does not measure impedance by measuring responses in a first and second position.

Still more specifically, the claims recite that ***the interface is between the first position and the second position***. The examiner has cited to c. 8, ll. 1-9 for the proposition that Hellemans discloses this feature. Hellemans, however, only discloses here that multiple voltage measurements may be taken along the sample, not that measurements on opposite sides of the interface may be used to determine impedance information.

For all of the foregoing reasons, applicant respectfully submits that the cited references, either taken alone or in combination, do not disclose or suggest the features of independent claim 8. Additionally, inasmuch as dependent claims 9-19 (which have also been rejected or objected to over the cited references) are dependent on claim 8, these claims are patentable over the cited references, at least by virtue of their dependency. Accordingly, applicant respectfully requests reversal of the rejections of and the objections to claims 8-19 under 35 U.S.C. § 103.

9. APPENDIX

1. (Withdrawn) A method for determining a magnetic force profile of a sample by using a cantilevered probe having a magnetic tip, the method comprising the steps of:

traversing the tip along a predetermined path on the surface of the sample, the tip being proximate the surface of the sample while traversing along the predetermined path;

determining the sample surface topography along the path;

substantially canceling the sample surface potential along the path using the determined sample surface topography; and

determining magnetic force data along the path based on the determined surface topography, wherein the determined magnetic force data is not magnetic force gradient data and the determined magnetic force data includes substantially no components from the sample surface potential.

2. (Withdrawn) The method as recited in claim 1, wherein the steps of substantially canceling the sample surface potential and determining magnetic force data are performed substantially simultaneously.

3. (Withdrawn) The method as recited in claim 1, wherein the steps of determining the sample surface topography, substantially canceling the sample surface potential, and determining magnetic force data are performed substantially simultaneously.

4. (Withdrawn) The method as recited in claim 1, wherein the step of substantially canceling the sample surface potential comprises:

determining the sample surface potential along the path based on the determined sample topography;

applying a dc signal to the tip, the dc signal substantially canceling the sample surface potential.

5. (Withdrawn) The method as recited in claim 4, wherein the step of determining sample surface potential is performed with scanning surface potential microscopy.

6. (Withdrawn) The method as recited in claim 4, wherein the step of determining sample surface potential comprises applying an ac signal to the tip, wherein the ac signal is set to a resonant frequency of the cantilevered tip.

7. (Withdrawn) The method as recited in claim 6, wherein the step of determining magnetic force data comprises applying an ac signal to the sample, the frequency of the ac signal applied to the sample being different from the frequency of the ac signal applied to the tip.

8. (Original) A method for determining impedance information of an interface in a sample, the method comprising the steps of:

(a) applying an ac voltage to the sample, laterally across the interface, the ac voltage having a predetermined frequency;

(b) disposing a cantilevered tip in a first position proximate to a surface of the sample;

(c) measuring a first response of the cantilevered tip with the cantilevered tip in the first position;

(d) placing the cantilevered tip in a second position proximate to the surface of the sample, the interface being between the first position and the second position;

(e) measuring a second response of the cantilevered tip with the cantilevered tip in the second position; and

(f) determining impedance information of the interface based upon the measured first response and the measured second response.

9. (Original) The method as recited in claim 8, wherein the step of:

measuring a first response comprises measuring a first phase angle of deflection of the cantilevered tip;

measuring a second response comprises measuring a second phase angle of deflection of the cantilevered tip; and

determining impedance information comprises:

determining a phase shift based upon the first phase angle and the second phase angle; and

determining impedance information of the interface based upon the phase shift and the frequency of the ac voltage.

10. (Original) The method as recited in claim 9, wherein the step of determining impedance information further comprises determining an impedance product of the interface according to:

$$\tan(\varphi_{gb}) = \frac{\omega C_{gb} R_{gb}^2}{(R + R_{gb}) + R\omega^2 C_{gb}^2 R_{gb}^2}$$

where C_{gb} is the capacitance of the interface;
R_{gb} is the resistance of the interface;
ω is the frequency of the ac voltage;
φ_{gb} is the phase shift; and
R is a resistance of a current limiting resistor in series with the sample.

11. (Original) The method as recited in claim 9, further comprising the step of:

selecting the frequency ω of the ac voltage such that $\tan(\varphi_{gb})$ is proportional to ω^{-1}; and

wherein the step of determining impedance information further comprises determining the capacitance of the interface according to:

$$\tan(\varphi_{gb}) = \frac{1}{\omega R C_{gb}}$$

where C_{gb} is the capacitance of the interface;
ω is the frequency of the ac voltage;
φ_{gb} is the phase shift; and
R is a resistance of a current limiting resistor in series with the sample.

12. (Original) The method as recited in claim 9, further comprising the step of:

selecting the frequency ω of the ac voltage such that $\tan(\varphi_{gb})$ proportional to ω; and

wherein the step of determining impedance information further comprises determining the resistance of the interface according to:

$$\tan(\varphi_{gb}) = \frac{\omega C_{gb} R_{gb}^2}{(R + R_{gb})}$$

where R_{gb} is the resistance of the interface;

C_{gb} is the capacitance of the interface;

ω is the frequency of the ac voltage;

φ_{gb} is the phase shift; and

R is a resistance of a current limiting resistor in series with the sample.

13. (Original) The method as recited in claim 8, wherein the step of:

measuring a first response comprises measuring a first amplitude of deflection of the cantilevered tip;

measuring a second response comprises measuring a second amplitude of deflection of the cantilevered tip; and

determining impedance information comprises:

determining an amplitude ratio based upon the measured first amplitude and the measured second amplitude; and

determining an impedance of the interface based upon the amplitude ratio and the frequency of the ac voltage.

14. (Original) The method of claim 13, wherein the step of determining the impedance further comprises determining the impedance according to:

$$\beta^{-2} = \frac{\left\{(R + R_{gb}) + R\omega^2 C_{gb}^2 R_{gb}^2\right\}^2 + \omega^2 C_{gb}^2 R_{gb}^4}{R^2\left(1 + \omega^2 C_{gb}^2 R_{gb}^2\right)^2}$$

where β is amplitude ratio across the interface,

C_{gb} is the capacitance of the interface,

R_{gb} is the resistance of the interface,

ω is the frequency of the ac voltage, and

R is a resistance of a current limiting resistor in series with the sample.

15. (Original) The method as recited in claim 8, wherein the step of:

measuring a first response comprises the steps of:

measuring a first phase angle of deflection of the cantilevered tip; and

measuring a first amplitude of deflection of the cantilevered tip;

measuring a second response comprises:

measuring a second phase angle of deflection of the cantilevered tip; and

measuring a second amplitude of deflection of the cantilevered tip; and

determining impedance information comprises:

determining a phase shift based upon the measured first phase angle and the measured second phase angle;

determining an amplitude ratio based upon the measured first amplitude and the measured second amplitude; and

determining an impedance of the interface based upon the phase shift and the amplitude ratio.

16. (Original) The method as recited in claim 15, wherein the step of determining an impedance of the interface comprises solving the following equations:

$$\beta^{-2} = \frac{\left\{\left(R + R_{gb}\right) + R\omega^2 C_{gb}^2 R_{gb}^2\right\}^2 + \omega^2 C_{gb}^2 R_{gb}^4}{R^2\left(1 + \omega^2 C_{gb}^2 R_{gb}^2\right)^2}$$

$$\tan\left(\varphi_{gb}\right) = \frac{\omega C_{gb} R_{gb}^2}{\left(R + R_{gb}\right) + R\omega^2 C_{gb}^2 R_{gb}^2}$$

where β is amplitude ratio across the interface,

C_{gb} is the capacitance of the interface,

R_{gb} is the resistance of the interface,

φ_{gb} is the phase shift;

ω is the frequency of the ac voltage, and

R is a resistance of a current limiting resistor in series with the sample.

17. (Original) The method as recited in claim 15, further comprising the steps of:

repeating each step of claim 15, for each of a predefined plurality of ac voltage frequencies; and

determining an impedance of the interface as a function of frequency based upon the determined phase shifts and amplitude ratios.

18. (Original) The method as recited in claim 15 wherein the step of determining an impedance further comprises determining the impedance of the interface based upon the phase shift and amplitude ratio and the frequency of the ac voltage by using the circuit termination comprised of average resistive and capacitive components determined by conventional impedance spectroscopy by measuring the frequency dependence of phase angle or measuring phase angle and amplitude ratio at a single frequency with a least square fit procedure.

19. (Original) The method as recited claim 15 further comprising the steps of:

repeating each step of claim 15 and applying a first dc signal laterally across the interface while performing each measuring step;

repeating each step of claim 15 and applying a second dc signal laterally across the interface while performing each measuring step; and

determining dc signal bias dependence of the interface resistance and capacitance based upon the first and second dc signal.

20. (Withdrawn) A system for determining impedance information of an interface in a sample, the system comprising:

a function generator that applies an ac voltage having a defined frequency and a dc voltage to the sample;

a cantilevered tip for placement proximate to the sample;

a controller, coupled to the cantilevered tip, that measures a deflection of the cantilevered tip;

a lock-in amplifier, coupled to the function generator and the controller, that determines the phase shift and amplitude of the deflection of the cantilevered tip; and

a processor that determines an impedance based value of the interface based on the phase shift and the frequency of the ac voltage.

Date: November 1, 2004

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